# Chapter 1239 Geometric Cross Section – Shoulders, Side Slopes, Curbs, and Medians



## 1239.01 Introduction

This chapter provides information on geometric cross section components that are common to many facility types. Cross section elements include: shoulders, medians and outer separations, side slopes, and curbing.

Refer to the *Design Manual* Glossary for many of the terms used in this chapter. Refer to Chapter 300 for design documentation requirements.

## 1239.02 Shoulders

Shoulders are typically used on high or intermediate speed limited and non-limited access facilities, some rural contexts, as well as intermediate-speed locations that do not have streetsides (curb-sections) (see Chapter 1238). Intermediate-speed locations in suburban and urban contexts that utilize streetsides do not need to include a shoulder unless determined to be necessary by safety performance analysis, hydraulic analysis or engineering judgment.

Shoulders provide space to escape potential collisions or reduce their severity. They also provide a sense of openness, contributing to driver ease at higher speeds. Shoulders also reduce seepage adjacent to the traveled way by discharging stormwater farther away.

### *1239.02(1) Shoulder Width*

Shoulder width ranges for highways are shown in Exhibit 1239-1. Use the mode/function/performance approach (Chapter 1106) to choose a dimension from the range given.

**Exhibit 1239-1 Shoulder Widths for Highways**

| Highway Speed | Highway Type | Shoulder Width [1] [2] | |
|---|---|---|---|
| | | Inside | Outside |
| High speed | Freeway (including Interstate) | See Chapter 1232 | |
| | Other highway | 4’ – 10’ | 4’ – 10’ |
| Intermediate speed | All | 4’ – 8’ | 4’ – 8’ |
| Low speed | All | 0’ – 8’ [2] | 2’ – 8’ |

**Notes:**

[1] Bus use only shoulder width range is 12-ft to 14-ft.

[2] If curb or barrier present, see Exhibit 1239-9.

## 1239.02(1)(a) Shoulder Width Considerations

Exhibit 1239-2 lists considerations for choosing an appropriate shoulder width from the range given. The considerations listed help one to understand the modal needs and function associated with different shoulder widths.

Contact the Area Maintenance Superintendent to determine the shoulder width appropriate for maintenance operations. In some cases, a continuous width is not necessary; instead, the focus is placing the shoulder width near assets with high-frequency maintenance needs. Compare the added cost of the wider shoulders to the added benefits to maintenance operations as well as other benefits that may be derived (see Chapter 301).

The usable shoulder is the width necessary to provide the desired function (see Exhibit 1239-2). Usable shoulder width is less than the constructed shoulder width when vertical features (such as traffic barrier or walls) are at the edge of the shoulder. This is because drivers tend to shy away from the vertical feature. For widening for traffic barrier, see Chapter 1610. For requirements for lateral clearance to barrier or curb, see 1239.06.

Shoulder widths greater than 10 feet may encourage use as a travel lane. Therefore, use shoulders wider than 10 feet only to meet one of the listed functions (see Exhibit 1239-2).

When walls are placed adjacent to shoulders, see Chapters 730 and 740 for barrier guidance.

### Exhibit 1239-2 Shoulder Function & Modal Accommodation Width Considerations

| Shoulder Function | Shoulder Width Guidance [7] |
|---|---|
| Stopping out of the traffic lanes | 8 ft – 12 ft [1] |
| Minimum lateral clearance to curb or barrier | See 1239.06 |
| Hard shoulder running | 11 ft to 14 ft [2] |
| Bicycle use | 4 ft [3] |
| Pedestrian use | 4 ft [3] |
| Large-vehicle off-tracking on curves | Use turn simulation software to determine shoulder needs |
| U-turn turnouts | Varies – See Chapter 1310 |
| Maintenance operations | Varies [4] [5] |
| Law enforcement, emergency services & incident response | 8 ft [5] |
| Transit stops | See Chapter 1430 |
| Slow-vehicle turnouts and shoulder driving | See Chapter 1270 |
| Ramp meter storage | 8 – 12 ft [1] |
| HOV bypass | 10 – 14 ft [6] |
| Ferry holding | 8 ft – 12 ft [1] |
| For use as a lane during reconstruction of the through lanes | 8 ft – 12 ft [1] |
| Structural support of pavement | 2 ft |
| Improve sight distance in cut sections | See Chapter 1260 |

**Notes:**

[1] 10 foot minimum recommended for freight or transit vehicles.

[2] For bus use only shoulder, the range is 12 ft to 14 ft and the selected width should be determined with transit provider. For lateral clearance requirements see 1239.06.

[3] Minimum shoulder function width for bicycles. Additional width is recommended when combined with shoulder rumble strips, curb, or barrier (see Chapter 1600 and the *Standard Plans*). For guidance, see Chapter 1520 for accommodating bicycles and Chapter 1510 for accommodating pedestrians.

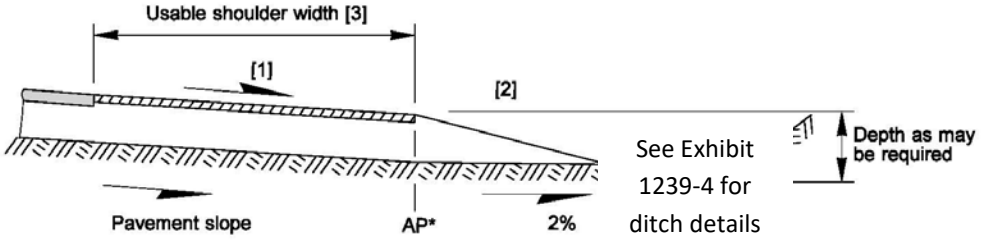
[4] 10 foot usable width to park a maintenance truck out of the through lane; 14 foot width for equipment with outriggers to work out of traffic.

[5] For additional information, see Chapters 1370, 1410 and 1720.

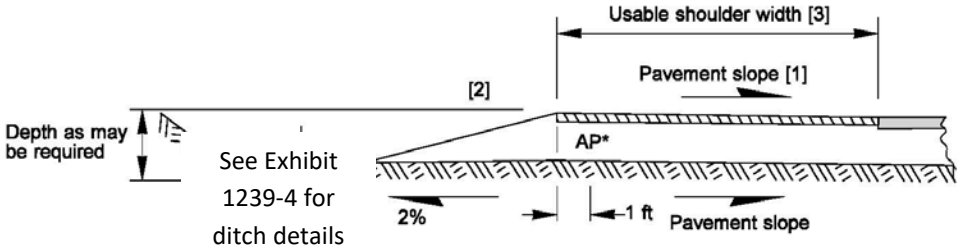
[6] Determine width with transit provider, and see 1239.06 for lateral clearance requirements.

[7] Presence of barrier or curb may require additional width. Use auto turn studies for non-tangent alignments.

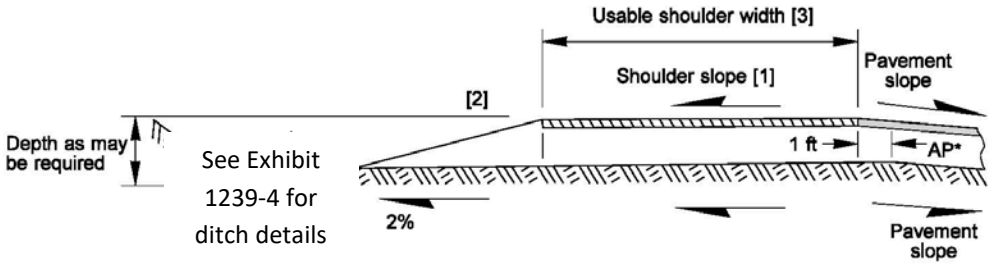
## Exhibit 1239-3 Shoulder Details



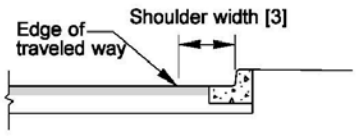

*Shoulder Design on the Low Side of the Roadway for Cross Slopes Greater Than 2%*




*Shoulder Design on the High Side of the Roadway on Curves and Divided Roadways Shoulder Slopes With Roadway*




*Shoulder Design on the High Side of the Roadway on Curves and Divided Roadways Shoulder Slopes Away From Roadway*



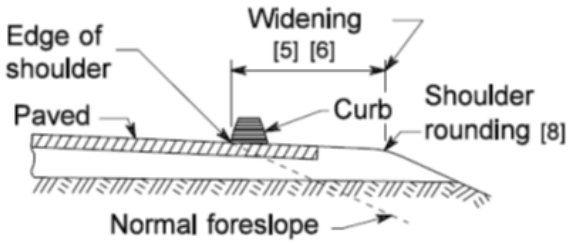

*Shoulder Design with Curb* [4] [5]

*AP = Angle point in the subgrade

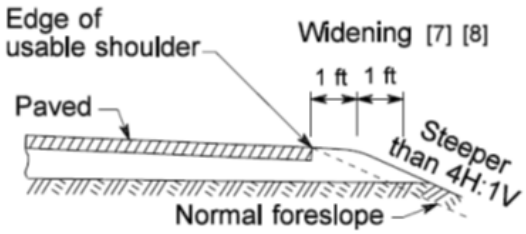
**Notes:**

- The top three drawings illustrate angle points in subgrade to drain stormwater away from the roadbed.
- For applicable numbered notes, see next page.

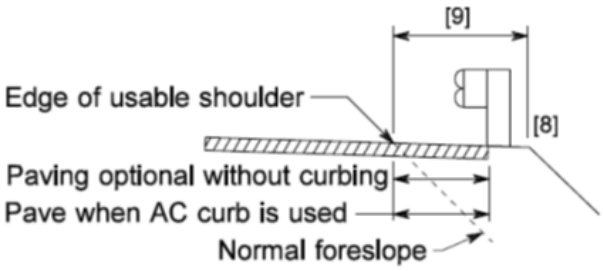
**Exhibit 1239-3 Shoulder Details (continued)**



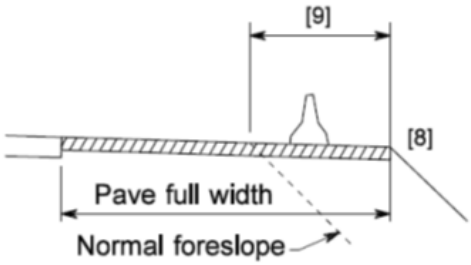

**Asphalt Concrete Curb Placement**




**Shoulder Rounding** [2]




**Shoulder Widening for Guardrail**




**Shoulder Widening for Barrier**

**Notes:**

[1] Shoulder cross slopes are normally the same as the cross slopes for adjacent lanes. (For examples and additional information for locations where it may be desirable to have a shoulder cross slope different than the adjacent lane, see Chapter 1250).

[2] Provide widening and slope rounding outside the usable shoulder when foreslope is steeper than 4H:1V.

[3] For shoulder width guidance, see Exhibit 1239-1.

[4] For additional requirements for sidewalks, see Chapter 1510.

[5] See 1239.05 for curb design guidance.

[6] Provide paved shoulders wherever extruded curb is placed. (See the *Standard Plans* for additional details and dimensions.)

[7] When rounding is provided, consider uniform application on all ramps and crossroads, as well as the main roadway. End rounding on the crossroad just beyond the ramp terminals and at a similar location where only a grade separation is involved.

[8] When widening beyond the edge of usable shoulder for curb or barrier, additional widening for slope rounding may be omitted.

[9] For widening guidelines for guardrail and concrete barrier, see Chapter 1610.

**General:**

On divided multilane highways, see Exhibits 1239-12a through 1239-12c for additional details for median shoulders.

## 1239.03 Side Slopes and Ditches

The design for side slopes can affect shoulder design, clear zone requirements, and whether or not traffic barrier is necessary. Side slopes are more commonly encountered in high-speed and/or rural contexts. After the foreslope has been determined, use the guidance in Chapter 1600 to determine the need for a traffic barrier.

When designing side slopes, attempt to fit the slope selected for any cut or fill into the existing terrain to give a smooth transitional blend from the construction to the existing landscape when practicable. Flatter slopes are desirable, especially with higher posted speeds and when the associated cost does not significantly exceed other design options. Side slopes not steeper than 4H:1V, with smooth transitions where the slope changes, will provide a reasonable opportunity to recover control of an errant vehicle. Side slopes designed to 4H:1V or flatter are preferred. Provide widening and slope rounding outside the usable shoulder when foreslope is steeper than 4H:1V. Do not disturb existing stable cut slopes just to meet the 4H:1V side slope preference. When an existing slope is to be revised, document the reason for the change in the BOD.

3H:1V side slopes are traversable, but not necessarily recoverable. If providing 3H:1V slopes, consider placement of a flat area extending from the toe of the slope for errant vehicle recovery (see Chapter 1600). Where mowing is contemplated, provide slopes not steeper than 3H:1V to allow for mowing. If there will be continuous traffic barrier on a fill slope, and mowing is not contemplated, the slope may be steeper than 3H:1V. When providing side slopes steeper than 3H:1V, document the reason for the decision.

Where unusual geological features or soil conditions exist, treatment of the slopes depends upon results of a review of the location by the Region Materials Engineer (RME).

Do not install traffic barrier unless an object or condition is present that calls for mitigation in accordance with Chapter 1600 criteria. Unmitigated critical slopes will require a Design Analysis. The steepest slope allowed is determined by the soil conditions. Where favorable soil conditions exist, higher fill slopes may be as steep as 1½H:1V. (See Chapter 1600 for clear zone and barrier criteria.)

If borrow is necessary, consider obtaining it by flattening cut slopes uniformly on one or both sides of the highway. Where considering wasting excess material on an existing side slope, consult the RME to verify that the foundation soil will support the additional material.

Provide for drainage from the roadway surface and drainage in ditches (see Chapter 800). For drainage ditches, see 1239.03(1). At locations where vegetated filter areas or detention facilities will be established to improve highway runoff water quality, provide appropriate slope, space, and soil conditions for that purpose. (See the *Highway Runoff Manual* for design criteria and additional guidance.)

Except under guardrail installations, it is desirable to plant and establish low-growing vegetation on non-paved roadsides. This type of treatment relies on the placement of a lift of compost or topsoil over base course material in the roadway cross section. Consult with the area Maintenance Superintendent and the region or HQ Landscape Architect to determine the appropriate configuration of the roadway cross section and soil and plant specifications.

Flatten crossroad and road approach foreslopes to 6H:1V where feasible, and consider at least to 4H:1V. Provide smooth transitions between the main line foreslopes and the crossroad or

road approach foreslopes. Where possible, move the crossroad or road approach drainage away from the main line. This can locate the pipe outside the Design Clear Zone and reduce the length of pipe.

Provide slope treatment as shown in the *Standard Plans* at the top of roadway cut slopes except for cuts in solid rock. Unless Class B slope treatment is called for, Class A slope treatment is used. Call for Class B slope treatment where space is limited, such as where right of way is restricted.

## 1239.03(1) Drainage Ditches

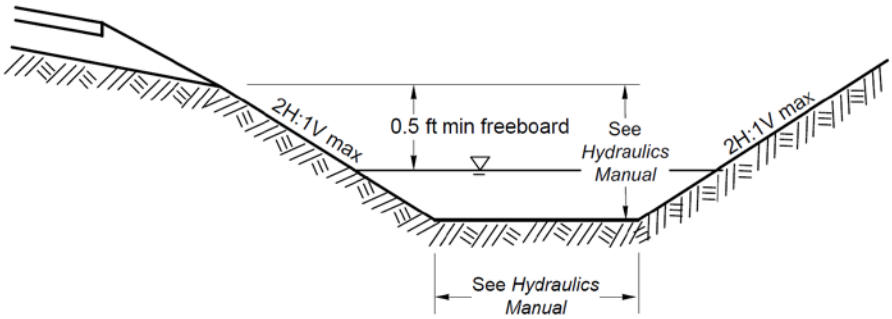
Exhibit 1239-4 provides general information regarding drainage ditch design. The preferred cross section of a ditch is trapezoidal as shown. A 'V' ditch can be used where constraints, such as limited right of way or sensitive areas, preclude a trapezoidal ditch. Ensure hydraulic design requirements are met.

Where a drainage ditch is located adjacent to the toe of a side slope, consider the stability of the foreslope and backslope. A drainage ditch placed immediately adjacent to the toe of side slopes has the effect of increasing the height of the side slope by the depth of the ditch. In cases where the foundation soil is weak, the extra height could result in a side slope failure. As a general rule, the weaker the foundation and the higher the side slopes, the farther the ditch should be from the toe of slope. Consult the Region Materials Engineer for the proper ditch location.

When topographic restrictions exist, consider an enclosed drainage system with appropriate inlets and outlets.

Maintenance operations are also facilitated by adequate width between the toe of the slope and an adjacent drainage ditch. Where this type of facility is anticipated, provide sufficient right of way for access to the facility and place the drainage ditch near the right of way line.

**Exhibit 1239-4 Drainage Ditch Details**




**Notes:**

- Freeboard is the vertical distance from the bottom of base course to the 10-year storm water surface (see the Hydraulics Manual for more information.)
- Coordinate ditch design with region Hydraulics
- See other sections of this chapter for shoulder and side slope details. 1239.03(2) Bridge End Slopes

## *1239.03(2) Bridge End Slopes*

Bridge end slopes are determined by several factors, including context, fill height, depth of cut, soil stability, and horizontal and vertical alignment. Coordinate bridge end slope treatment with the HQ Bridge and Structures Office (see Chapter 720). Whenever possible, design to avoid creating environments that might be desirable to the homeless, both for their safety and the safety of maintenance staff.

Early in the bridge plan development, determine preliminary bridge geometrics, end slope rates, and toe of slope treatments. Exhibit 1239-5a provides guidelines for use of slope rates and toe of slope treatments for overcrossings. Exhibit 1239-5b shows toe of slope treatments to be used on the various toe conditions.

**Exhibit 1239-5a Bridge End Slopes**

<table>
<tr><th>Bridge End Condition</th><th colspan="2">Toe of Slope End Slope Rate</th><th colspan="2">Lower Roadway Treatment [1]</th><th>Slope Rate</th></tr>
<tr><td rowspan="2">End Piers on Fill</td><td>Height</td><td>Rate</td><td>Posted speed of lower roadway</td><td>Treatment</td><td></td></tr>
<tr><td>≤ 35 ft<br>> 35 ft</td><td>1¾H:1V<br>2H:1V [2]</td><td>> 50 mph<br>≤ 50 mph</td><td>Rounding<br>No rounding</td><td></td></tr>
<tr><td>End Piers in Cut</td><td colspan="2">Match lower roadway slope [3]</td><td colspan="2">No rounding, toe at centerline of the lower roadway ditch.</td><td>[4]</td></tr>
<tr><td>Lower Roadway in Cut</td><td colspan="2">Match lower roadway slope [3]</td><td colspan="2">No rounding, toe at centerline of the lower roadway ditch.</td><td>[4]</td></tr>
<tr><td rowspan="2">Ends in Partial Cut and Fill</td><td colspan="2">When the cut depth is > 5 ft and length is > 100 ft, match cut slope of the lower roadway</td><td colspan="2">When the cut depth is > 5 ft and length is > 100 ft, no rounding, toe at centerline of the lower roadway ditch</td><td>[4]</td></tr>
<tr><td colspan="2">When the cut depth is ≤ 5 ft or the length is ≤ 100 ft, it is designer’s choice</td><td colspan="2">When the cut depth is ≤ 5 ft or the length is ≤ 100 ft, it is designer’s choice</td><td>[4]</td></tr>
</table>

**Notes:**

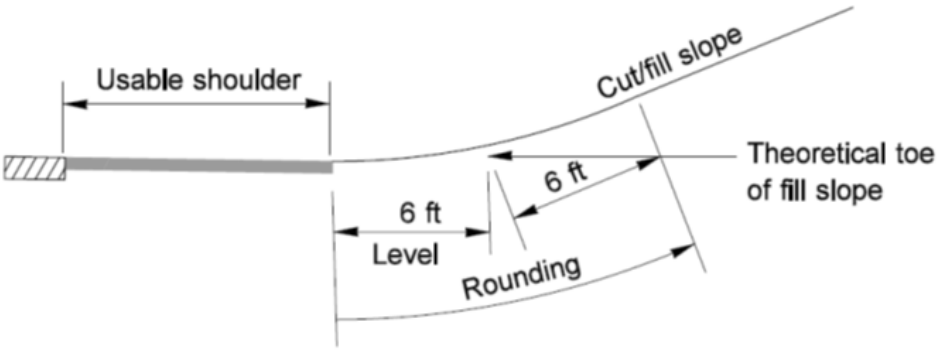
[1] See Exhibit 1239-5b.

[2] Slope may be 1¾H:1V in special cases.

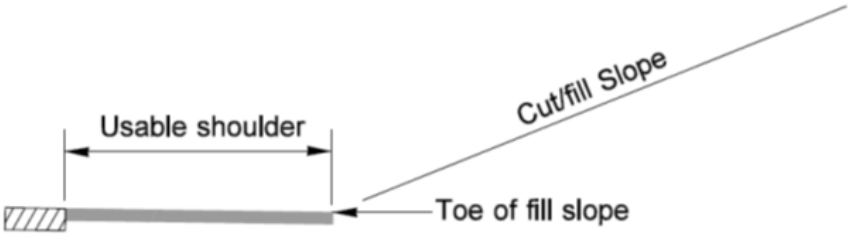
[3] In interchange areas, continuity may require variations.

[4] See 1239.03.

**Exhibit 1239-5b Bridge End Slope Details**




***Rounding***




***No Rounding***


***Toe at ℄ of Roadway Ditch***

## 1239.04 Roadway Sections in Rock Cuts

There are two basic design treatments applicable to rock excavation. Typical sections for rock cuts, illustrated in Exhibits 1239-6 and 1239-7, are guides for the design and construction of roadways through rock cuts. Design A applies to most rock cuts. Design B is a talus slope treatment. Changes in slope or fallout area are recommended when justified. Base the selection of the appropriate sections on an engineering study and the recommendations of the region Materials Engineer and region Landscape Architect. Obtain concurrence from the Headquarters (HQ) Materials Lab.

### *1239.04(1) Design A*

This design is shown in stage development to aid the designer in selecting an appropriate section for site conditions in regard to backslope, probable rockfall, hardness of rock, and so on.

The following guidelines apply to the various stages shown in Exhibit 1239-6:

- **Stage 1** is used where the anticipated quantity of rockfall is small, adequate fallout width can be provided, and the rock slope is ½H:1V or steeper. Controlled blasting is recommended in conjunction with Stage 1 construction.
- **Stage 2** is used when a "rocks in the road" problem exists or is anticipated. Consider it on flat slopes where rocks are apt to roll rather than fall.
- **Stage 3** represents the full implementation of all protection and safety measures applicable to rock control. Use it when extreme rockfall conditions exist.

Show Stage 3 as the ultimate stage for future construction in the Plans, Specifications, and Estimates (PS&E) if there is any possibility that it will be needed.

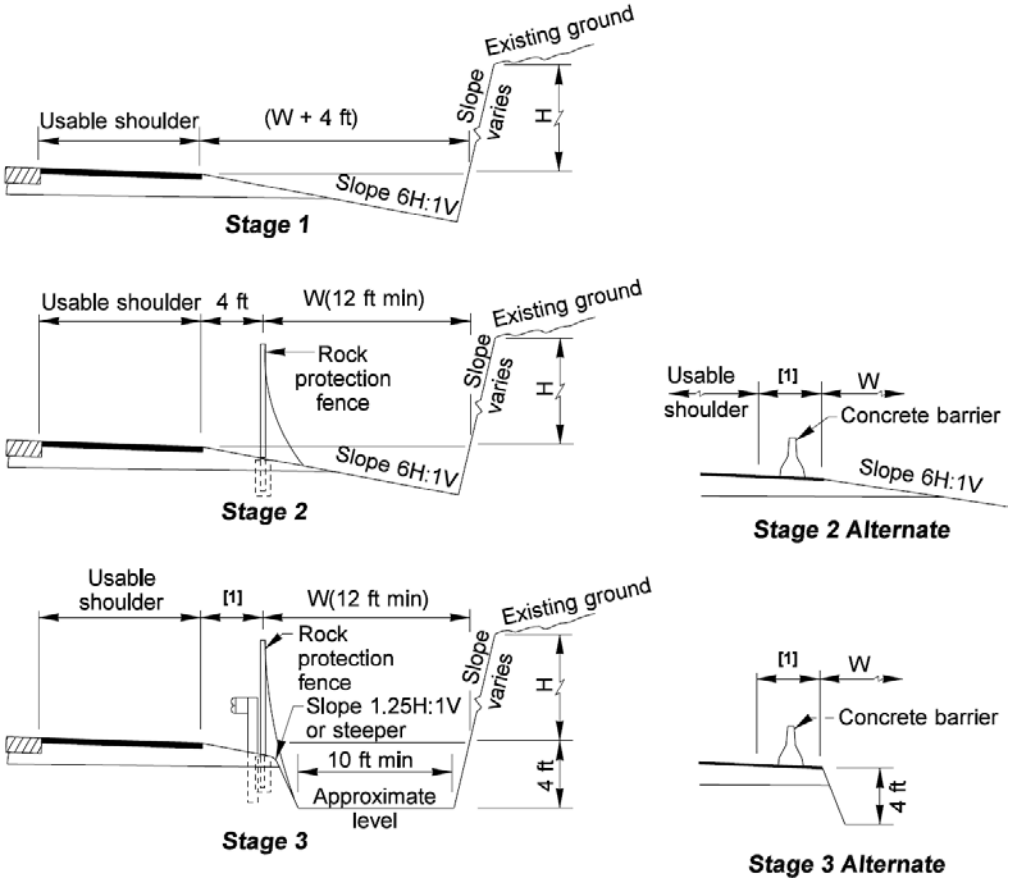
The use of Stage 2 or Stage 3 alternatives (concrete barrier) is based on the designer's analysis of the particular site. Considerations include maintenance; size and amount of rockfall; probable velocities; availability of materials; ditch capacity; adjacent traffic volumes; distance from traveled lane; and impact severity. Incorporate removable sections in the barrier at approximately 200-foot intervals. Provide appropriate terminal treatment (see Chapter 1610).

Occasionally, the existing ground above the top of the cut is on a slope approximating the design cut slope. The height (H) is to include the existing slope or that portion that can logically be considered part of the cut. Select cut slopes for a project that provide stability for the existing material.

Benches may be used to increase slope stability; however, the use of benches may alter the design given in Exhibit 1239-6.

The necessity for benches, as well as their width and vertical spacing, is established after an evaluation of slope stability. Make benches at least 20 feet wide. Provide access for maintenance equipment to the lowest bench and to the higher benches if feasible. Greater traffic benefits in the form of added safety, increased horizontal sight distance on curves, and other desirable attributes may be realized from widening a cut rather than benching.

### Exhibit 1239-6 Roadway Sections in Rock Cuts: Design A




| Rock Slope | H (ft) | W (ft) |
|---|---|---|
| Near Vertical | 20 – 30 | 12 |
| | 30 – 60 | 15 |
| | > 60 | 20 |
| 0.25H:1V through 0.50H:1V | 20 – 30 | 12 |
| | 30 – 60 | 15 |
| | 60 – 100 | 20 |
| | >100 | 25 |

**Notes:**

[1] For widening for guardrail and concrete barrier, see Chapter 1610.

**General:**

- Treat cut heights less than 20 feet as a normal roadway unless otherwise determined by the Region Materials Engineer.
- Stage 2 and Stage 3 Alternates may be used when site conditions dictate.
- Fence may be used in conjunction with the Stage 3 Alternate. (See Chapter 1600 for clear zone guidelines.)

## *1239.04(2) Design B*

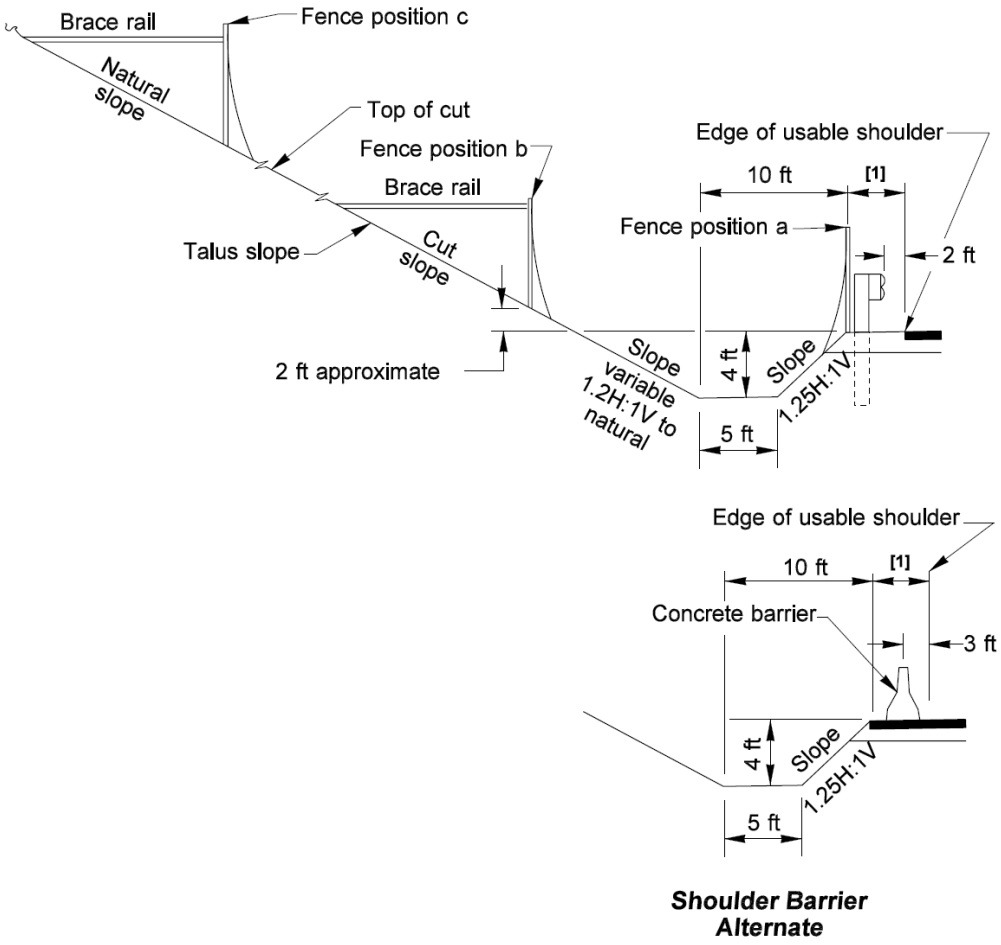
A talus slope treatment is shown in 1239-7. The rock protection fence is placed at any one of the three positions shown, but not in more than one position at a particular location. Consult with the RME for the placement of the rock protection fence in talus slope areas.

- **Fence position a** is used when the cliff generates boulders less than 0.25 $yd^3$ in size and the length of the slope is greater than 350 feet.
- **Fence position b** is the preferred location for most applications.
- **Fence position c** is used when the cliff generates boulders greater than 0.25 $yd^3$ in size regardless of the length of the slope. On short slopes, this may require placing the fence less than 100 feet from the base of the cliff.
- Use of gabions may be considered instead of the rock protection shown in fence position a. Because gabion treatment is considered similar to a wall, provide appropriate face and end protection (see Chapters 730 and 1610).

Use of the alternate shoulder barrier is based on the designer's analysis of the particular site. Considerations similar to those given for Design A alternatives apply.

Evaluate the need for rock protection treatments other than those described above for cut slopes that have relatively uniform spalling surfaces (consult with the RME).

### Exhibit 1239-7 Roadway Sections in Rock Cuts: Design B




***Shoulder Barrier Alternate***

**Notes:**

[1] For widening for guardrail and concrete barrier, see Chapter 1610.

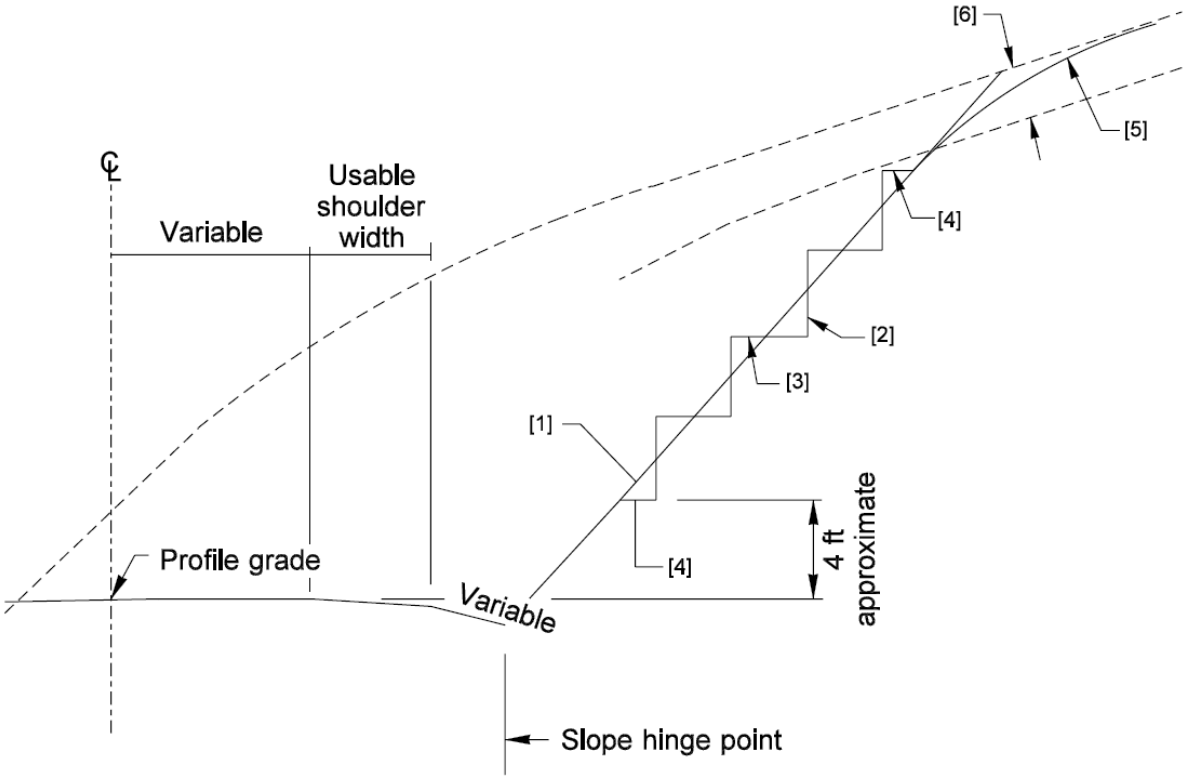
**General:**

- Ordinarily, place fence within a zone of 100 feet to 200 feet maximum from base of cliff, measured along the slope.
- Rock protection fence may be used in conjunction with the Shoulder Barrier Alternate when site conditions dictate.

## *1239.04(3) Stepped Slopes*

Stepped slopes are a construction method intended to promote early establishment of vegetative cover on the slopes. They consist of a series of small horizontal steps or terraces on the face of the cut slope. Soil conditions dictate the feasibility and necessity of stepped slopes. They are to be considered on the recommendation of the RME (see Chapter 610). Consult the region landscape personnel for appropriate design and vegetative materials to be used. Use Exhibit 1239-8 for stepped slope design.

**Exhibit 1239-8 Stepped Slope Design**




**Notes:**

[1] Staked slope line: Maximum slope 1H:1V.

[2] Step rise: Height variable 1 foot to 2 feet.

[3] Step tread: Width = staked slope ratio x step rise.

[4] Step termini: Width ½-step tread width.

[5] Slope rounding.

[6] Overburden area: Variable slope ratio.

## 1239.05 Curbs

Curbs are designated as either vertical or sloped. Vertical curbs have a face slope not flatter than 1H:3V. Sloped curbs have a sloping face that is more readily traversed.

Curbs can also be classified as mountable. Mountable curbs are sloped curb with a height of 6 inches or less; 4 inches or less is recommended to reduce underside vehicle damage if driven over. When the face slope is steeper than 1H:1V, the height of a mountable curb is limited to 4 inches or less.

(a) Use vertical curbs with a height of 6 inches or more:

- To inhibit vehicles from leaving the roadway on low-speed roadways.
- To discourage vehicles from leaving low - and intermediate-speed roadways.
- For walkway and pedestrian refuge separations.
- For raised islands on which a traffic signal or traffic signal hardware is located.
- For expediting transfer times for transit partners on low- speed roadways in urban and suburban contexts (verify curb height needed with transit provider).

(b) Consider vertical curbs with a height of 6 inches or more:

- To inhibit midblock left turns.
- For divisional and channelizing islands.
- For landscaped islands.
- For stormwater conveyance

(c) Provide sloped curbs where a curb is needed but vertical curb is not suitable.

(d) Provide mountable curbs where a curb is needed and accommodation for specific design users makes it necessary.

(e) See Chapter 1320 for use of curbs in roundabouts.

In general, curbs are not recommended on high-speed facilities. Avoid using curbs if the same objective can be attained with pavement markings. However, 4-inch-high sloped curbs may be used on high-speed facilities to control drainage or for access control. Locate sloped curb no closer to the traveled way than the outer edge of the shoulder. Provide sloping end treatments where the curb is introduced and terminated. 6-inch-high sloped curbs may be considered on high-speed urban and suburban contexts where streetside zones are provided or where traffic movements are to be restricted. Provide justification for the use of vertical curb when applied to high-speed facilities.

Intermediate speed facilities may use vertical or sloped curbs; however, consider sloped curbs for intermediate target speeds. Consider use of 12-inch to 18-inch vertical curb when analysis demonstrates a need to reduce lane departure concerns on intermediate-speed facilities. All curb types are appropriate for low-speed facilities.

Where curbing is to be provided, provide a design that collects the surface water at the curb and drains it without ponding or flowing across the roadway as much as practicable to meet the safety and mobility performance needs for a project.

In some areas, curb may be needed to control runoff water until ground cover is attained to control erosion. Plan to remove the curb when the ground cover becomes adequate. Arrange

for curb removal with region maintenance staff as part of the future maintenance plans (see Maintenance Owner's Manual guidance in Chapter 301). When curb is used in conjunction with guardrail, see Chapter 1610 for guidance. For existing curb, particularly on high-speed facilities, evaluate the continued need for the curb. Remove curbing that is no longer needed.

When an overlay will reduce the height of a curb, evaluate grinding (or replacing the curb) to maintain curb height if recommended by the pavement design and drainage needs. (See 1230.06(1) for shoulder cross slope considerations.) To maintain or restore curb height, consider lowering the existing pavement level and improving cross slope by grinding before an asphalt overlay or as determined by the pavement design. The cross slope of the shoulder may be steepened to maximize curb height and minimize other related impacts. Note that grinding can cause issues with meeting ADA criteria at curb ramps for counter slope and crosswalk running slope. See Chapter 1510 for more information.

Curbs can hamper snow-removal operations. In areas of heavy snowfall, get the Area Maintenance Superintendent's review for the use of curbing.

For curbs at traffic islands, see Chapter 1310. For curbs at roundabouts, see Chapter 1320 and the *Standard Plans*.

## 1239.06 Lateral Clearance to Curb and Barrier

*Lateral clearance to curb or barrier* is the perpendicular distance from edge of traveled way to the face of a curb or a traffic barrier (guardrail, concrete barrier, etc.). Lateral clearance includes the shoulder width. The minimum lateral clearance to the face of a curb or barrier is shown in Exhibit 1239-9. See also Chapter 1310 for intersections including clearance to curb at traffic islands.

**Exhibit 1239-9 Minimum Lateral Clearance to Barrier and Curb**

<table>
<tr><th></th><th>Curb<br>Left or Right [1] [2]</th><th>Barrier</th></tr>
<tr><td>High Speed</td><td rowspan="2">4 ft; curb not recommended</td><td rowspan="3">4 ft</td></tr>
<tr><td>Intermediate Speed</td></tr>
<tr><td>Low Speed</td><td>2 ft min. [3] [4]</td></tr>
<tr><td>Ramps [5]</td><td>4 ft</td><td></td></tr>
</table>

**Notes:**

[1] For HOV lanes on arterials streets, see Section 1410.06(4)(d)

[2] Measured from the edge of traveled way to the face of curb.

[3] When mountable curb is used on low speed routes (35 mph or less), maintaining shoulder width is desirable; however, with justification, curb may be placed at the edge of traveled way.

[4] On low speed urban roadways (35 mph or less), maintaining shoulder width is desirable; however, with justification, curb (mountable or non-mountable) may be placed at the edge of traveled way.

[5] Raised median for two-way ramps (see 1360.03(5).)

## 1239.07 Medians and Outer Separations

Medians are either restrictive or nonrestrictive. Restrictive medians physically limit motor vehicle encroachment, using raised curb, median barrier, fixed delineators, vegetative strips, or vegetative depressions. Nonrestrictive medians limit motor vehicle encroachment legally, and use pavement markings to define locations where turns are permissible. The main functions of an outer separation are to separate the main roadway from a frontage road or service lane, or to provide modal segregation. Consider medians or outer separations to optimize the desired performance objective, such as safety, throughput operations, pedestrian mobility needs, etc.

Provide a median or outer separation to:

- Separate traffic (such as with HOT lanes) and/or modal users (such as bike buffers).
- Separate differing alignments on divided highways.
- Reduce head-on collisions.
- Manage speed.
- Provide a refuge area for emergency parking.
- Allow for future widening of a planned phase.
- Separate collector-distributor lanes, weigh sites, or rest areas.
- Accommodate drainage facilities.
- Accommodate bridge piers at undercrossings.
- Provide vehicle storage space for crossing and left-turn movements at intersections.
- Accommodate headlight glare screens, including planted or natural foliage.
- Provide recovery areas for errant or disabled vehicles.
- Accommodate pedestrian refuge area at crossing locations.
- Provide storage space for snow and water from traffic lanes.
- Provide increased safety, comfort, and ease of operations for different modes.
- Control access.
- Provide enforcement areas.

The width of a median is measured from edge of traveled way to edge of traveled way and includes shoulders. Median widths can vary greatly based on the functional use of the median, target speed, and context. Guidance for median widths depending on their function and context is given in Exhibits 1239-10 and 1239-11.

## *1239.07(1) Median Design: High and Intermediate Speed*

Exhibit 1239-10 lists width considerations for median functions common on high-speed facilities. Depending on the context and performance needs, this guidance may also apply to intermediate speed facilities as well.

When the horizontal and vertical alignments of the two roadways of a divided highway are independent of one another, determine median side slopes in conformance with 1239.03 and Chapters 1600 and 1610. Independent horizontal and vertical alignment, rather than parallel alignment, can allow for reduced grading or cut sections.

Considerable latitude in grading treatment is intended on wide, variable-width medians, provided the minimum performance needs are met or exceeded. Unnecessary clearing, grubbing, and grading are undesirable within wide medians. Use selective thinning and limited reshaping of the natural ground when feasible. For median clear zone criteria see Chapter 1600, and for slopes between the face of traffic barriers and the traveled way see Chapter 1610.

In areas where land is expensive, make an economic comparison of wide medians to narrow medians with barrier. Consider right of way, construction, maintenance, and safety performance. The widths of medians need not be uniform. Make the transition between median widths as long as practical. (See Chapter 1210 for minimum taper lengths.)

When using concrete barriers in depressed medians or on curves, provide for surface drainage on both sides of the barrier. The transverse notches in the base of precast concrete barrier are not intended to be used as a drainage feature, but rather as pick-up points when placing the sections.

At locations where the median will be used to allow vehicles to make a U-turn, consider increasing the width to meet the needs of the selected design vehicles making the U-turn. (For information on U-turn locations, see Chapter 1310.) Document the selected design vehicle and provide alternate route information for vehicles not serviced by the U-turn.

Where feasible, widen medians at intersections on rural divided multilane highways. Provide sufficient width to store vehicles crossing the expressway or entering the expressway with a left turn.

When the median is to be landscaped, or where rigid objects are to be placed in the median, see Chapter 1600 for traffic barrier and clear zone guidance. When the median will transition for use as a left-turn lane, see Chapter 1310 for left-turn lane design considerations.

**Exhibit 1239-10 Median Functions and Guidance: High and Intermediate Speeds**

| Median Functional Use | Width Guidance |
|---|---|
| Separating opposing traffic | Varies[1] and see Chapters 1600 and 1610 |
| Separating alignments | Varies See 1239.03 and Chapters 1600 and 1610 [2] |
| Recovery/Refuge areas for errant vehicles | See 1239.03 and Chapter 1600 |
| Median signing and illumination – Undivided highways and ramps | 6 ft [1] or as recommended for signing and illumination design |
| Storage space for snow | Consult Region Maintenance |
| Enforcement areas | See Chapters 1370 and 1410, and consult with Washington State Patrol |
| Vehicle storage space for crossing at intersections | See Chapter 1310, and consult with region traffic engineer |
| Median U-turn or Median crossover | See Chapters 1310 and 1370 |
| Outer separation for frontage or collector-distributer | 6 ft – or more [1] and see Chapters 1360, 1600 and 1610 |
| Transit use | Varies; see Chapter 1420 and discuss with Transit Agency [3] |

**Notes:**

[1] Conduct safety performance analysis and include potential countermeasures identified to obtain the desired safety performance. Consult with maintenance; additional width may be appropriate for unconstrained right of way locations, maintenance functions, or for divided highways on independent alignments.

[2] An economic comparison of wide medians to narrow medians with barrier is recommended.

[3] For planning and scoping purposes, 32 ft can be the assumed minimum for two-way transit operations or 22 ft for one-way transit operations.

## *1239.07(2) Median Design: Low and Intermediate Speeds*

Exhibit 1239-11 provides design guidance for medians within low-speed transportation contexts. Depending on the context and performance needs, this guidance may also apply to intermediate speed facilities as well. In low-speed urban and suburban contexts, see Chapter 1600 for Design Clear Zone requirements.

A common form of restrictive median on urban managed access highways is the raised median. For more information on traffic volume thresholds for restrictive medians on managed access highways, see Chapter 540.

### Exhibit 1239-11 Median Functions and Guidance: Low and Intermediate Speeds

| Median Functional Use | Width Guidance |
|---|---|
| Access Control – Restrictive | Width of raised median feature [1] [2] |
| Access Control – Non-restrictive | 1 ft minimum [3] (see Chapter 540) |
| Pedestrian refuge for crossing locations | 6 ft minimum, excluding curb width (see Chapter 1510) |
| Speed management and/or aesthetic design – Vegetated | Varies [2] [4] (see Chapter 1103) |
| Drainage or treatment facilities | Varies [5] |
| Bike buffer treatment | 2 ft – 3 ft (see Chapter 1520) |
| Transit connection | Varies [6] (see Chapters 1238 and 1430) |
| Outer separation used for a pedestrian zone | 9 ft – 16 ft [4] [7] [8] |

**Notes:**

[1] The width of a raised median can be minimized by using a dual-faced cement concrete traffic curb, a precast traffic curb, or an extruded curb.

[2] Consider width necessary for lateral clearance.

[3] 2 ft minimum if adjacent lane widths are less than 11 ft.

[4] Consult Region Landscape Architect; width will depend on type of plantings. Over-excavation may be necessary to prepare soil for the selected plantings to ensure mature heights are obtained.

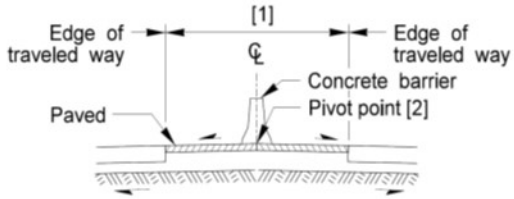
[5] Consult Hydraulic Report for width necessary for drainage or treatment facilities.

[6] Consult with the transit provider. If a transit shelter is planned, a minimum 5 ft clear area measured from the edge of shelter roofing to face of curb width, is necessary for pedestrians to move to and around the shelter and for lift extension (see Chapter 1430).

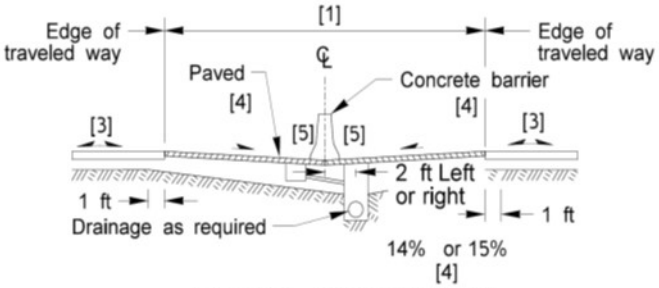
[7] Consider width needed for plantings or street furniture to create the appropriate pedestrian zone segregation and environment.

[8] See also Chapter 1510

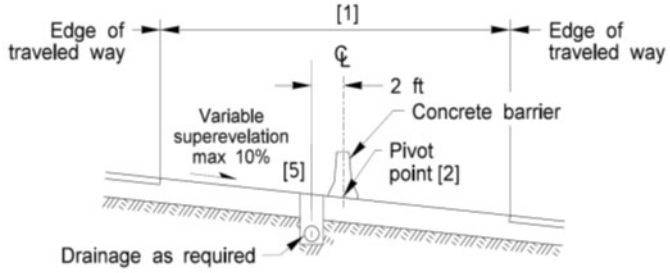
## Exhibit 1239-12a Divided Highway Median Sections



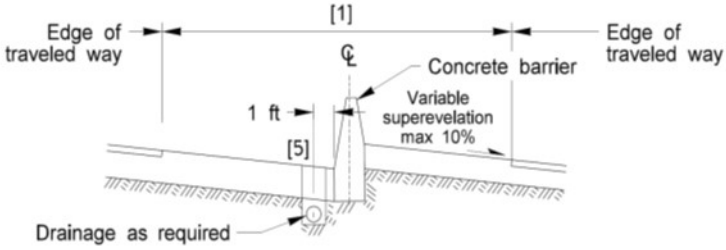

**Design A: Crowned Median**




**Design: B Depressed Median**



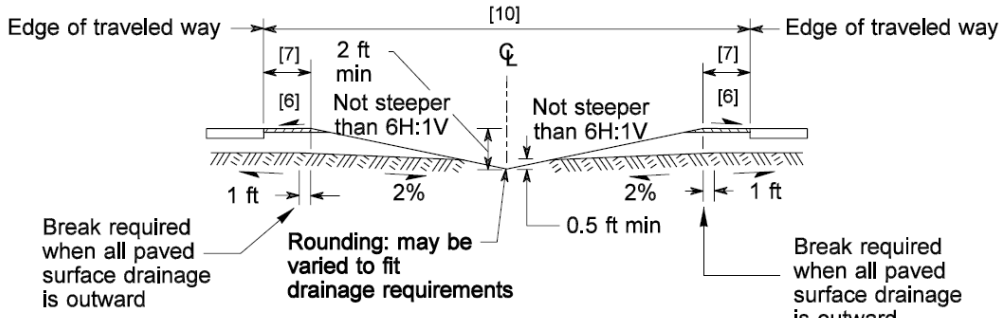

**Alternate Design 1: Treatment on Curves**



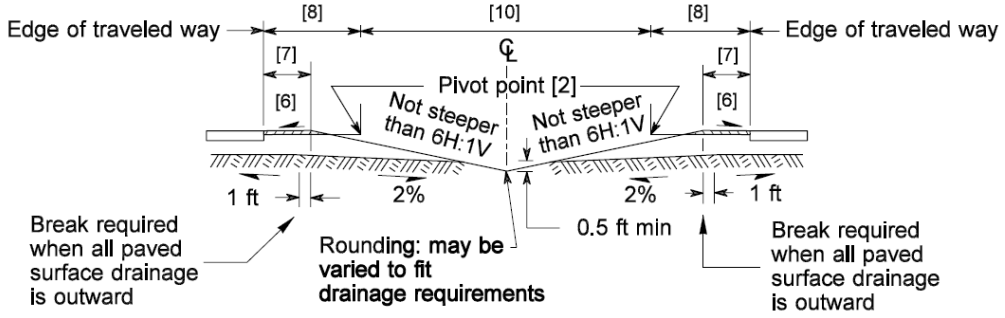

**Alternate Design 2: No Fixed Pivot Point [2]**

**Note:**
For applicable notes, see Exhibit 1239-12c.

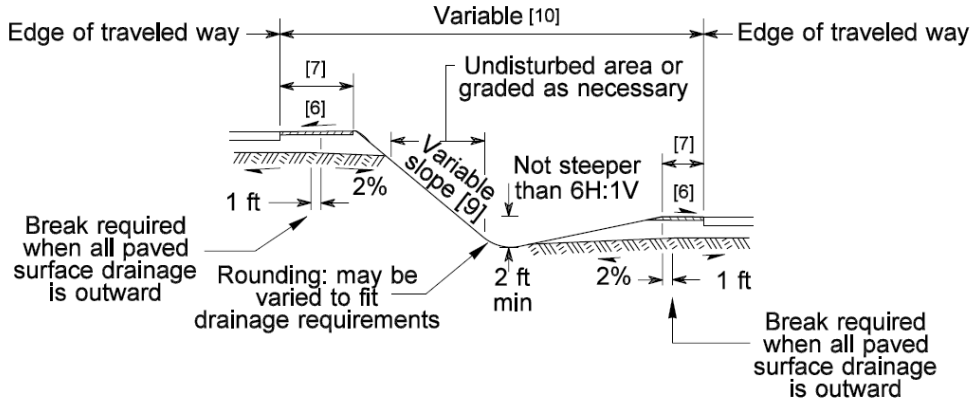
### Exhibit 1239-12b Divided Highway Median Sections




**Design C: Minimum Nonpaved Median For 4 or More Lanes [2]**



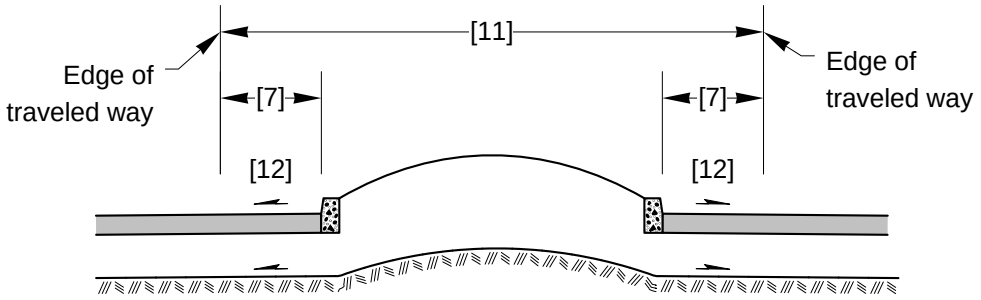

**Design D: Minimum for 4 or More Lanes With Future Lanes in Median**




**Design E: Minimum for 4 or More Lanes With Independent Alignment**

**Note:**
For applicable notes, see Exhibit 1239-12c.

**Exhibit 1239-12c Divided Highway Median Sections**




## Design F: Raised Median[13]

**Notes:**

[1] For guidance on median widths, see Exhibits 1239-10 and -11

[2] Consider vertical clearances, drainage, and aesthetics when locating the pivot point.

[3] Generally, slope pavement away from the median. When barrier is present and the roadway is in a superelevation, size the shoulder so that standing water is not in the travel lane. Where appropriate, a crowned roadway section may be used in conjunction with the depressed median.

[4] Design B may be used uniformly on both tangents and horizontal curves. Use Alternate Design 1 or Alternate Design 2 when the "rollover" between the shoulder and the inside lane on the high side of a superelevated curve exceeds 8%. Provide suitable transitions at each end of the curve for the various conditions encountered in applying the alternate to the basic median design.

[5] Method of drainage pickup to be determined by the designer.

[6] Median shoulders normally slope in the same direction and rate as the adjacent through lane. See 1250.02(2) for examples and additional information for locations where it may be desirable to have a shoulder cross slope different than the adjacent lane.

[7] For guidance on shoulder widths, see 1239.02.

[8] Future lane width of a planned phase.

[9] Widen and round foreslopes steeper than 4H:1V as shown in Exhibit 1239-3. See Chapter 1600 for barrier recommendations.

[10] Designs C, D, and E are rural high-speed median designs. See Exhibit 1239-10 for recommended median widths.

[11] Raised medians may be paved or landscaped. For clear zone and barrier guidelines when fixed objects or trees are in the median, see Chapter 1600.

[12] Lane and shoulders normally slope away from raised medians. When they slope toward the median, provide for drainage.

[13] See 1239.05 and 1239.06 for curb design guidance.